12/31/03

1. (Currently Amended) A semiconductor light emitting device comprising:

a substrate[[,]]; and

a light emitting layer forming portion disposed on said substrate so that an active layer that emits light by electric current injection is sandwiched between n-type and p-type cladding layers made of materials having a larger band gap than said active layer,

wherein said active layer is made of ~~an~~ a ZnO-based oxide compound semiconductor containing at least ~~one of~~ Cd ~~and Zn~~.

2. (Original) The semiconductor light emitting device of claim 1, wherein said cladding layers are made of ZnO-based oxide compound semiconductor.

3. (Original) The semiconductor light emitting device of claim 1, wherein said cladding layers are made of Group III nitride compound semiconductor.

4. (Original) The semiconductor light emitting device of claim 1, 2 or 3, wherein said active layer is made of $Cd_xZn_{1-x}O$ ($0 \leq x < 1$).

5. (Currently Amended) A semiconductor light emitting device comprising:

~~an active layer that emits light by electric current injection, and~~

~~cladding layers made of materials having a larger band gap than said active layer, said cladding layers sandwiching said active layer from both sides thereof,~~

a single crystalline substrate; and

a light emitting layer forming portion disposed on said substrate so that an active layer that emits light by electric current injection is sandwiched between n-type and p-type cladding layers made of materials having a larger band gap than said active layer

wherein said cladding layers are made of an ZnO-based oxide compound semiconductor containing Zn or Mg and ~~an~~ Zn.

6. (Original) The semiconductor light emitting device of claim 5, wherein said cladding layers are made of $Mg_yZn_{1-y}O$ ($0 \leq y < 1$).

7. (Original) The semiconductor light emitting device of claim 1, 2, 3, 4, 5 or 6, wherein the substrate on which said cladding layers and said active layer are laminated is one kind selected from the group consisting of GaN, Si having SiC formed thereon, single crystal SiC, and sapphire.

8. (Original) The semiconductor light emitting device of claim 1, 2, 3, 4, 5, 6 or 7, wherein said active layer is a single quantum well structure or a multiple quantum well structure.

9. (Original) A semiconductor laser comprising:

an active layer that emits light by electric current injection, and

n-type and p-type cladding layers made of materials having a larger band gap than said active layer and sandwiching said active layer from both sides thereof,

wherein said active layer is made of $Cd_xZn_{1-x}O$ ($0 \leq x < 1$), said cladding layers are made of $Mg_yZn_{1-y}O$ ($0 \leq y < 1$), and an internal electric current constriction layer is built therein.

Claim 10(cancelled)

11. (Original) The semiconductor light emitting device of claim 1, wherein said active layer is made of a bulk layer of $Cd_xZn_{1-x}O$ ($0 \leq x < 1$)or a quantum well structure constructed with a composition modification of $Cd_xZn_{1-x}O$ ($0 \leq x < 1$) , and a stress-alleviating layer is disposed on at least one side of said n-type cladding layer side and said p-type cladding layer side of said active layer so as to be in contact with said active layer, said stress-alleviating layer being made of a material having a larger band gap than said active layer and having a composition with approximately the same lattice constant as a material of the composition located on the outermost side of said active layer on said at least one side.

12. (Original) The semiconductor light emitting device of claim 11, wherein said stress-alleviating layer is made of $Mg_wZn_{1-w}O$ ($0 \leq w < 1$), and said cladding layers are made of oxide compound semiconductor containing Mg and Zn.

13. (Original) A semiconductor laser comprising:

an active layer that emits light by electric current injection, and

n-type and p-type cladding layers made of materials having a larger band gap than said active layer and sandwiching said active layer from both sides thereof,

wherein said active layer is made of a quantum well structure constructed with a composition modification of $Cd_xZn_{1-x}O$ ($0 \leq x < 1$), and a stress-alleviating layer is disposed on at least one side of said n-type cladding layer side and said p-type cladding layer side of said active layer so as to be in contact with said active layer, said stress-alleviating layer being made of $Mg_wZn_{1-x}O$ ($0 \leq w < 1$) having a composition with approximately the same lattice constant as the composition located on the outermost side of said active layer on said at least one side.

14. (Original) The semiconductor laser of claim 13, wherein said cladding layers are made of $Mg_yZn_{1-y}O$ ($0 \leq y < 1$), and an optical wave guide layer is disposed between said stress-alleviating layer and said n-type or p-type cladding layer.

15. (Original) The semiconductor light emitting device of claim 4, wherein a low-temperature ZnO layer is disposed at least on said active layer side between said active layer and an upper cladding layer.

16. (Original) The semiconductor light emitting device of claim 15, wherein said low-temperature ZnO layer is disposed to have a thickness from 100 to 1000 Å.

Claim 17(cancelled)

18. (Original) A semiconductor light emitting device comprising:

a sapphire substrate,

a buffer layer made of an $A1_2O_3$ film disposed on said sapphire substrate, and

a light emitting layer forming portion made of ZnO-based compound semiconductor disposed on said buffer layer, said light emitting layer forming portion including at least n-type and p-type layers to form a light emitting layer.

19. (Original) The semiconductor light emitting device of claim 18, wherein said light emitting layer forming portion has a double heterojunction structure in which an active layer made of $Cd_xZn_{1-x}O$ ($0 \leq x < 1$) is sandwiched between n-type and p-type cladding layers made of $Mg_yZn_{1-y}O$ ($0 \leq y < 1$).

Claim 20(cancelled)

21. (Original) A semiconductor light emitting device comprising:

a substrate, and

a semiconductor laminate section disposed on said substrate and made of oxide compound semiconductor layers and including a light emitting layer forming portion,

wherein an oxide thin film containing Zn is disposed as a buffer layer on a front surface of said substrate at a lower temperature than a temperature of growing

semiconductor layers of said semiconductor laminate section and is interposed between said substrate and said semiconductor laminate section.

22. (Original) The semiconductor light emitting device of claim 21, wherein said buffer layer is formed to have a thickness of 20 to 200 nm by an MBE method, an MOCVD method, or a plasma CVD method between 100 and 300°C.

23. (Original) A method of manufacturing a semiconductor light emitting device comprising the steps of:

forming a non-crystalline or polycrystalline oxide thin film containing Zn on a substrate by a sputtering method, a vacuum vapor deposition method, or a laser ablation method,

putting said substrate into an apparatus for epitaxial growth of semiconductor layers and raising a substrate temperature to a growth temperature, and

laminating an oxide compound semiconductor layer to form a light emitting layer forming portion.

24. (Original) A semiconductor light emitting device comprising:

a substrate, and

a semiconductor laminate section including a light emitting layer forming portion made of compound semiconductor layers disposed on said substrate and having n-type and p-type layers to form a light emitting layer,

wherein a buffer layer is disposed between said substrate and said semiconductor laminate section, said buffer layer being made of a material having a thermal expansion coefficient larger than the thermal expansion coefficient of an epitaxial growth layer at the lowermost layer of said semiconductor laminate section and smaller than the thermal expansion coefficient of said substrate.

25. (Original) The semiconductor light emitting device of claim 24, wherein said substrate is made of a sapphire substrate; wherein the epitaxial growth layer of said lowermost layer is made of a ZnO-based compound semiconductor; and wherein said buffer layer is a compound semiconductor having a wurtzite structure.

26. (Original) The semiconductor light emitting device of claim 25, wherein said buffer layer is made of $A1_pGa_{1-p}N$ ($0 \leq p < 1$).

27. (Currently amended) ~~A semiconductor~~ The semiconductor light emitting device of claim 1, further comprising:

~~a substrate,~~

a reflective film for reflecting light from a front surface side of said substrate, and

a semiconductor laminate section,

wherein said reflective film is laminated by an even number of dielectric films or semiconductor films having different refractive indices with a thickness of $\lambda/(4n)$ (n is a refractive index of the dielectric film or the semiconductor film, and λ is a light

emission wavelength) on said substrate so that a layer having a smaller refractive index and a layer having a larger refractive index are alternately laminated in this order; and

wherein, in said semiconductor laminate section, semiconductor layers are laminated on said reflective film to form a the light emitting layer.

28. (Currently amended) A semiconductor light emitting device comprising:

a substrate;

a reflective film for reflecting light from a front surface side of said substrate;

a semiconductor laminate section; and

wherein said reflective film is laminated by an even number of dielectric films or semiconductor films having different refractive indices with a thickness of $\lambda/(4n)$ (n is a refractive index of the dielectric film or the semiconductor film, and λ is a light emission wavelength) on said substrate so that a layer having a smaller refractive index and a layer having a larger refractive index are alternately laminated in this order, and

wherein, in said semiconductor laminate section, semiconductor layers are laminated on said reflective film to form a the light emitting layer, and

~~The semiconductor light emitting device of claim 27,~~ wherein a buffer layer made of oxide containing Zn and formed at a low temperature is disposed on said reflective film; and wherein said semiconductor laminate section is formed by lamination of oxide compound semiconductor on said buffer layer.

29. (Original) The semiconductor light emitting device of claim 28, wherein said buffer layer is formed by forming a non-crystalline or polycrystalline oxide thin film containing Zn by a sputtering method, a vacuum vapor deposition method, or a laser ablation method, and said semiconductor laminate section is formed by lamination of a ZnO-based compound semiconductor on said buffer layer.

30. (Original) A ZnO-based compound semiconductor light emitting device comprising:

a substrate; and

a light emitting layer forming portion disposed on said substrate and forming a light emitting layer by lamination of ZnO-based compound semiconductor having at least an n-type layer, wherein an n-side electrode disposed in contact with said n-type layer of said ZnO-based compound semiconductor is formed so that a portion of said n-side electrode which is in contact with said n-type layer is formed of Ti or Cr, said portion not containing A1.

31. (Original) The semiconductor light emitting device of claim 30, wherein a layer containing Ti and A1 is disposed on said layer of Ti or Cr.

32. (Original) The semiconductor light emitting device of claim 31, wherein said Ti and A1 are formed into an alloy by an annealing treatment after said layer containing Ti and A1 is formed.

Claims 33-38(cancelled)

39. (Original) A semiconductor light emitting device comprising:

a substrate, and

a light emitting layer forming portion made of ZnO-based compound semiconductor layers disposed on said substrate and forming a light emitting layer with an n-type layer and a p-type layer, wherein said p-type layer contains an element capable of becoming an n-type dopant as a buffering agent.

Claims 40-47(cancelled)

48. (Original) A ZnO-based compound semiconductor light emitting device comprising:

a substrate, and

a light emitting layer forming portion that forms a light emitting layer by lamination of a ZnO-based compound semiconductor layer disposed on said substrate,

wherein said ZnO-based compound semiconductor layer contains C element.

49. (Original) A semiconductor light emitting device of claim 48, wherein said C element is C of an organic metal compound used as a Zn material in growing said ZnO-based compound semiconductor layer.

Claim 50(cancelled)

51. (Original) A semiconductor laser comprising:

a substrate, a first cladding layer disposed on said substrate and made of a first conductivity type semiconductor,

an active layer disposed on said first cladding layer,

a second cladding layer disposed on said active layer and made of a second conductivity type semiconductor, and

an electric current constriction layer disposed in the inside of or in the vicinity of said second cladding layer,

wherein said electric current constriction layer is made of a ZnO-based compound semiconductor doped with a Group IA or Group VB element.

52. (Original) A semiconductor laser of claim 51, wherein said first cladding layer, said active layer, and said second cladding layer are made of ZnO-based or GaN-based compound semiconductor.

53. (Original) The semiconductor laser of claim 51 or 52, wherein said electric current constriction layer is made of $Mg_zZn_{1-z}O$ ($0 \leq z < 1$).

54. (Original) A semiconductor laser comprising:

a substrate,

a first cladding layer disposed on said substrate and made of a first conductivity type semiconductor,

an active layer disposed on said first cladding layer,

a second cladding layer disposed on said active layer and made of a second conductivity type semiconductor, and

an electric current constriction layer disposed in the inside of or in the vicinity of said second cladding layer and made of $Mg_zZn_{1-z}O$ ($0 \leq z < 1$),

wherein an etching stopping layer made of $Cd_sZn_{1-s}O$ ($0 < s < 1$) or $Be_tZn_{1-t}O$ ($0 < t < 1$) is disposed on said substrate side of said electric current constriction layer.

Claims 55-56(cancelled)

57. (Currently amended) An oxide compound semiconductor light emitting diode comprising:

an n-type layer made of an n-type ZnO-based compound semiconductor,

an i-layer made of a ~~semiinsulating~~ semi-insulating ZnO-based compound semiconductor, and

an electrically conductive layer disposed on a front surface of said i-layer.

58. (Original) An oxide compound semiconductor light emitting diode comprising:

an n-type layer made of an n-type ZnO-based compound semiconductor,

a doped layer in which a ZnO-based compound semiconductor layer is doped with at least one kind of element selected from the group consisting of Group IA, Group IB, and Group VB elements, and

an electrically conductive layer disposed on a front surface of said doped layer.

59. (Original) The semiconductor light emitting diode of claim 58, wherein said n-type layer is doped with a Group IIIB element.

60. (Original) A semiconductor light emitting device comprising:

a substrate, and

a light emitting layer forming portion disposed on said substrate and forming a light emitting layer by lamination of compound semiconductor layers having at least an n-type layer and a p-type layer, wherein said n-type layer is made of a ZnO-based compound semiconductor; and

wherein said p-type layer is made of a GaN-based compound semiconductor.

61. (Original) The semiconductor light emitting device of claim 60, wherein an active layer made of $Cd_xZn_{1-x}O$ ($0 \leq x \leq 0.5$) is disposed between said n-type layer and said p-type layer.

62. (Original) The semiconductor light emitting device of claim 61, wherein an n-type ZnO-based compound semiconductor layer made of a material having a larger band gap energy than said active layer is disposed between said active layer and said p-type layer.

63. (Original) A semiconductor light emitting device comprising:

an insulating substrate,

a light emitting layer forming portion formed of a p-type layer disposed on said insulating substrate and made of a GaN-based compound semiconductor and an

n-type layer disposed on said p-type layer and made of a ZnO-based compound semiconductor,

an n-side electrode disposed on said n-type layer, and

a p-side electrode disposed on said p-type layer which is exposed by removal of a portion of said ZnO-based compound semiconductor layer through etching.

64. (Original) The semiconductor light emitting device of claim 63, wherein said light emitting layer forming portion has a semiconductor laser structure having a p-type layer made of a GaN-based compound semiconductor, an active layer made of a ZnO-based compound semiconductor having a smaller band gap energy than said p-type layer, and an n-type layer made of a ZnO-based compound semiconductor having a larger band gap energy than said active layer; and wherein said laminated ZnO-based compound semiconductor layers are removed by etching except for a region for injecting an electric current into said active layer.

65. (Original) The semiconductor light emitting device of claim 64, wherein a buffer layer made of an n-type ZnO-based compound semiconductor having a larger band gap energy than said active layer is disposed between said p-type layer and said active layer.